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## THE REDISTRIBUTIVE IMPACT OF THE GENERAL OLD AGE PENSIONS ACT ON LIFETIME INCOME IN THE NETHERLANDS

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By means of a simple simulation model we will look at the effect of the General Old Age Pensions Act on the distribution of lifetime income in the Netherlands. In spite of the fact that premiums are proportional to income, whereas benefits are only dependent on marital status (married or unmarried),<sup>1</sup> the redistribution of income is rather limited. This is especially true for the vertical income redistribution within a generation. This is caused by differences in mortality rates and differences in the duration of working life between income groups.

### 1. Introduction

The aim of this paper is to study the influence of the Dutch General Old Age Pensions Act (GOAPA) on the distribution of lifetime income. This is done for the birth-generations 1905 to 1965 and for different income groups.

The research in this field is mainly theoretical [see, for example, Kessler and Masson (1985), Keyfitz (1985), Verbon (1985), Layard (1977), Castellino (1971), Atkinson (1970) and Prest (1970)]. In most cases assumptions such as a stable population, no intergenerational transfers, and so on, are made. This means that the results are not relevant for present generations. To obtain insight into the redistributive aspects of the GOAPA for present generations, we develop a simulation model. Before doing so, we give a description of the GOAPA system in the Netherlands. We then state our assumptions in section 3. The model is presented in section 4 and the results are set out in section 5. Section 6 discusses the effects of some of the assumptions, while section 7 contains a summary and ends with some conclusions.

### 2. The General Old Age Pensions Act in the Netherlands

Since 1 January 1957, the General Old Age Pensions Act has insured all

\*The author wishes to thank Prof. Dr. G.F. Frinking, Dr. J. Bartlema and an anonymous referee for their comments on an earlier draft. The research was carried out in the framework of the project entitled 'Problems relating to the distribution of social security'.

<sup>1</sup>An unmarried person gets 70% of the amount received by a married couple.

residents between the ages of 15 and 65 and has provided an old age pension from the age of 65. The GOAPA is financed by means of the pay-as-you-go system. The premium has to be paid by those insured, roughly speaking the people aged between 15 and 65. The premium is a percentage of the so-called premium income<sup>2</sup> (11.65% in 1984) and is levied up to the so-called maximum premium income or contribution limit (Dfl. 62,850 in 1984). For those who were over 15 years of age in 1957, when the GOAPA came into operation, temporary provisions were made. For persons born before 1 January 1942, but after 1 January 1892, the law provides that for the period between the moment they reached the age of 15 years and the moment the law came into force they are considered (under certain conditions) as being insured. Another temporary provision grants the right to a GOAPA benefit to persons who on 1 January 1957 had already reached the age of 65 and who have never been insured under this law.

Unlike the premiums, benefits are calculated on a flat-rate basis. At first it was a basic pension but the net benefit has been increased over the years to the same level as the net minimum wage, at least for married couples. Unmarried people receive 70% of the benefit a couple gets. In 1984 the benefit for a married couple amounted to Dfl. 19,734 gross per annum and for an unmarried person Dfl. 13,761. Before 1 April 1985 married women could not generally claim benefit. Their claims were included in those of their husbands. As from 1 April 1985 all people reaching the age of 65 will receive a benefit, with only a few exceptions. For a married person the benefit will be 50% of the amount that a married couple receives. When the partner of the person in question is younger than 65 years old, then he or she will receive a supplement. From 1 April 1988 this supplement will be dependent on the income of the partner.

Another change introduced in 1985 is that husband and wife have to pay, each separately, the GOAPA premium up to the maximum premium income. Before 1985 the premium incomes of husband and wife were taken together and the GOAPA premium was levied on this sum (up to the maximum premium income). For partners who both have a high income, this change means that they have to pay twice as much as before 1985.

So the structure of the General Old Age Pensions Act implies the following redistributive aspects:

- (1) Because of the fact that the GOAPA is financed by the pay-as-you-go

<sup>2</sup>The premium income is the income on which the premiums are levied. The following figures for the year 1984 give the premium income for different levels of the gross income or of the profit earned by self-employed people after deduction of stocks and 'old age reserves', but before deduction of the 'advance premium' and the allowance for self-employed people.

Gross wage/profit	20,000	30,000	40,000	50,000	60,000	70,000	80,000
Premium inc. employed	19,170	28,140	36,465	42,365	50,205	58,452	62,850
Premium inc. self-employed	13,330	22,464	31,205	39,945	48,686	57,426	62,850

system, the specific premium percentages are dependent on the population structure, so that changes in this structure lead to intergenerational transfers. Because of the ageing of the Dutch population this aspect is very important in the Netherlands.

(2) Before the revision of the law in 1985 couples had to pay premiums up to the (individual) maximum premium income; the same applied to single persons. For the latter the benefit is 70% of a couple's benefit. This, in combination with the level of the maximum premium income, implies a redistribution from unmarried to married people.

(3) The differences in mortality rates between men and women cause a redistribution from men to women.

(4) The temporary provisions (made in 1957) favour the generations born before 1942, especially those born around 1905.

Another relevant point is the fact that death rates differ between income groups. From the little information and literature available on death rates differentiated by income, it appears that these death rates are considerably higher for low-income groups than for high-income groups. From the studies by van Poppel (1978), Desplanques (1984), and Koskinen (1985) it appears that differences of 6 to 8 years for men and about 4 years for women are reasonable. This means that persons in higher income groups receive their GOAPA benefit for more years than persons in the lower income groups.

Moreover, the age at which a person starts working will, generally speaking (as a result of a longer period of education), be lower for the lower income groups than for the higher ones, so that the number of years a person pays GOAPA premiums will be higher for the lower income groups.

### 3. Assumptions of the model

(1) In the first place we assume that in the long run the income in year  $t+k$  ( $Y(t+k)$ ) is determined by the income in year  $t$  ( $Y(t)$ ) and by the growth rate of the income ( $w$ ) in the following way:

$$Y(t+k) = Y(t) \cdot \prod_{j=t}^{t+k-1} (1+w(j)), \quad k > 0. \quad (1)$$

We have taken the average gross income in the metallurgical industry for male manual workers between 15 and 65 years of age<sup>3</sup> to determine the growth rate of the income. This income has been chosen because it is the only relevant information available for the lengthy period under consideration.

(2) The next assumption we make is that the discount rate (the time preference)  $r(t)$  for the past will be equal to the average interest rate of new

<sup>3</sup>Source: Centraal Bureau voor de Statistiek (1979) and (1983).

mortgage loans.<sup>4</sup> For the period 1910–1983 the difference between this interest rate and the applied annual income growth rate ( $w$ ) is equal to 0.56% per annum on average. During the last few decades the average difference between the two has been slightly over 1% a year. For this reason we consider three variants for this difference  $((1+w(t))/(1+r(t)))$  in the future: 0, 1 and 2% (subvariants a, b and c, respectively).

(3) Furthermore, we assume for the future that the GOAPA benefits will develop in accordance with the general development of incomes, so that:

$$\text{GOAPA}(t+k) = \text{GOAPA}(t) \cdot \prod_{j=t}^{t+k-1} (1+w(j)). \quad (2)$$

Because of the link with the minimum wage and the first assumption, this assumption is quite logical.

(4) We apply the most recent life table (that for 1982) to all birth-generations.<sup>5</sup> The reason for this is that it is not possible to foresee the development in mortality patterns very far into the twenty-first century. We therefore use the same life table for all generations. We also assume that there are no differences in mortality by marital status.

(5) Because we do not know the income of aged couples in which one partner is younger than 65 and because we do not know the distribution of differences in age between married partners, we assume the maximum possible supplement. This means that married couples get 100% of the benefit for aged couples, from the moment the husband reaches the age of 65.<sup>6</sup> We assume that in a married couple the husband is on average 2.5 years older than his wife.<sup>7</sup> By means of the study by Koesoebjono (1981) and the Centraal Bureau voor de Statistiek (1984) we can calculate the average number of years lived in each state (married, widowed or divorced) for couples in which the husband is 65 years old. These couples live on average 11.9 years in the married state, the husband is widowed for 2.0 years on average and the wife for 8.7 years. Their average expectancy in the divorced state is 0.1 years.

(6) We assume that there will be no marriage or re-marriage after the age of 65.

(7) In the main variant we suppose that the 1945 and 1950 birth-generations pay their premiums from the age of 15, whereas the following generations pay from the age of 20.

<sup>4</sup>Source: Centraal Bureau voor de Statistiek (1979) and (1983).

<sup>5</sup>See Tas (1984).

<sup>6</sup>In 1981 there were about 500,000 married men of 65 years and older. These men had 46,600 working spouses. The mean income of these working spouses was Dfl. 5,000. So the numbers and the incomes are very small.

<sup>7</sup>This assumption is based on the results of the study by Frinking and van Poppel (1979).

(8) In doing the calculations we assume that the income is constant during working life (for example Dfl.30,000). In practice this is of course not the case: the income-age profile is not a straight line; in the first years of working life the income will grow (up to the age of 40/45), especially in the first years of working life. From the age of 40/45 to 55/59 we generally see a stabilization and after the age of 55/59 we note a slight decline.

#### 4. The derivation of the net GOAPA result

In this section we derive the formula for the expected net GOAPA result at age 65. The net GOAPA result is defined as the difference between the expected sum total of GOAPA benefits from the age of 65 onwards and the expected sum total of GOAPA contributions up to age 65.

For a person born in the year  $t-x$  with a premium income below the maximum, we can say, on the basis of assumptions (1) and (2), that the contribution for the GOAPA premium at age  $x$  ( $14 < x < 65$ ), discounted to the year  $t_1$  ( $\text{PAY}(x, t, t_1)$ ), is:

$$\begin{aligned}\text{PAY}(x, t, t_1) &= \text{prGOAPA}(t) \cdot Y(t_1) \cdot \prod_{j=t}^{t_1-1} (1+r(j))/(1+w(j)), & \text{if } t_1 > t, \\ &= \text{prGOAPA}(t) \cdot Y(t_1), & \text{if } t_1 = t, \\ &= \text{prGOAPA}(t) \cdot Y(t_1) \cdot \prod_{j=t_1}^{t-1} (1+w(j))/(1+r(j)), & \text{if } t_1 < t,\end{aligned}\quad (3)$$

where

$\text{prGOAPA}(t)$  is the GOAPA premium percentage in the year  $t$  (see appendix B),

$Y(t_1)$  is the income in the year  $t_1$  [see assumption (1)],

$r(j)$  is the discount rate,

$w(j)$  is the income growth rate.

If  $t < 1957$ , we take  $\text{prGOAPA}(t) = 0$ .

For the expected benefit from the GOAPA at age  $x$  ( $x > 64$ ), also discounted to the year  $t_1$  ( $\text{BEN}(x, t, t_1)$ ), we get:

$$\begin{aligned}\text{BEN}(x, t, t_1) &= 1(x) \text{GOAPA}(t_1) \cdot \prod_{j=t}^{t_1-1} (1+r(j))/(1+w(j)), & \text{if } t_1 > t, \\ &= 1(x) \cdot \text{GOAPA}(t_1), & \text{if } t_1 = t, \\ &= 1(x) \cdot \text{GOAPA}(t_1) \cdot \prod_{j=t_1}^{t-1} (1+w(j))/(1+r(j)), & \text{if } t_1 < t,\end{aligned}\quad (4)$$



in which

- $c_1(t)$  is the correction factor for the level of the GOAPA benefits;  $c_1(t) = 1$  for  $t > 1972$ ; for the period before 1973, see appendix A,  
 $c_2$  is the correction factor for the maximum premium income,  
 $Y_{\max}(t)$  is the maximum premium income in the year  $t$ .

In the next section we use this formula to compute the expected net result of the General Old Age Pensions Act for different birth-generations.

## 5. The results

In this section we calculate the expected net result of the General Old Age Pensions Act by means of formula (6). In other words we calculate the difference between expected received benefits and expected paid premiums. We do this for the 1905–1965 birth-generations, in which we distinguish different household incomes (corrected for price inflation and real income growth, in 1984 prices), ranging from Dfl. 10,000 a year to the maximum premium income of Dfl. 62,850 (for unmarried people) and twice the maximum premium income (married couples in the basic variant). As we mentioned before, there are three subvariants:  $(1 + w(t))/(1 + r(t)) = 0, 0.01$  and  $0.02$ , respectively, for the years 1984–2075 (subvariants a, b and c). For the starting-year  $t$ , we take 1984. The relevant data is given in section 2. The calculations are done for married couples and for people that were unmarried at the age of 65.

In the first instance we do not take into account differences in mortality rates between income groups. This is called the basic variant. The results are given in appendix C, table C1. We see that the expected net GOAPA result in subvariant a is the highest for the 1905 generation. This generation paid premiums for only a few years, but received a benefit from the moment they were 65 years old. Depending on the level of the income, we see that the net result decreases after 1905. Starting from 1935 (for unmarried people) and 1945 (married couples) the net result can be negative, dependent on the level of the income: in other words, more premiums are paid during one's working life than will be received as benefits. The net result is lower when the income is higher (up to the maximum premium income). Next, we can conclude that, when the income is the same (not counting couples born after 1920 for whom the sum of the husband's and wife's combined income liable for premium contributions is higher than Dfl. 80,000), unmarried men have a lower net result than married people and unmarried women. The difference between unmarried men and unmarried women is caused by the difference in life expectancy, whereas the difference between married and unmarried men is caused by the difference in the level of the benefit to married and unmarried persons, respectively. The expected sum from GOAPA benefits



amounts to Dfl. 384,830 for married couples, Dfl 192,654 for unmarried men and Dfl. 254,579 for unmarried women (for generations after 1915). Thus, a married couple in which the husband was born in 1965 and with an average income during working life equal to the maximum premium income pay (for the assumptions used) slightly over 1.25 times the amount that he may expect to receive. Unmarried men of that generation and with the same income are likely to pay 2.4 times the amount that will be in store for them to receive, whereas unmarried women pay relatively less: 1.8 times the expected benefit. For generations born after 1965 the net result will be even more negative.

The decrease in the net result for generations born after 1941 (these generations have to pay their premiums throughout the whole period of insurance) is almost completely due to the influence of changes in the structure of the population, particularly the relative increase in the number of people older than 65, in relation to the number of people between 15 and 64 years old.<sup>8</sup> As a consequence, the development in the net result is very clear: a significant decrease since 1945, especially in the higher income groups. As a result of the further increase of this ratio the net result for subsequent birth-generations will be lower yet. No change can be expected within the next few decades.

The law amendment of 1 April 1985 means that married people have to pay premiums based on their income, each up to the maximum premium income. As a result, households in which husband and wife have to pay more than the maximum (individual) premium income contribute more to the GOAPA system than before. The added premium contributions can be derived from table C1; this is the difference between the net result of the premium income on which premium has to be paid after 1 April 1985 and the net result which results from an income equal to the maximum premium income (Dfl. 62,850). If a married couple in which the husband was born in 1955 have to pay the premium on an income of Dfl. 90,000 starting on the above-mentioned date, then the net result is -Dfl. 140,000. If the law had not been changed, the net result would be -Dfl. 70,000. We thus have a

<sup>8</sup>The number of people aged 15 to 64 years in relation to the number of people aged 65 or older is given below for some generations and ages.

Age \ Generation	15	25	35	45	55	65
1905	no GOAPA contributions				6.8	6.2
1915				6.8	6.2	5.8
1925			6.8	6.2	5.8	5.4
1935		6.8	6.2	5.8	5.4	5.0
1945	6.8	6.2	5.8	5.4	5.0	4.5
1955	6.2	5.8	5.4	5.0	4.5	3.4
1965	5.8	5.4	5.0	4.5	3.4	2.7

Table 1

The premium percentage at which the expected net result is equal for everyone; differences in mortality rates and the duration of working life are not taken into account (basic variant).

	Premium income					
	20	30	40	50	60	62.850*
Married couples	34.9	23.3	17.5	14.0	11.6	11.1
Never married men	17.2	11.5	8.6	6.9	5.7	5.5
Never married women	25.7	17.1	12.8	10.3	8.6	8.2

  

	Premium income						
	70	80	90	100	110	120	125.7
Married couples	10.0	8.7	7.8	7.0	6.4	5.8	5.6

\*For incomes above Dfl. 62,850 the same premium percentage applies as for Dfl. 62,850 for unmarried people.

decrease of more than Dfl. 120,000. It must be pointed out that the number of people that will be affected by this measure is relatively insignificant: less than 3% of married couples have a premium income above Dfl. 62,850.

If we take into account subvariants b and c, the picture becomes less transparent. The maximum expected result is also dependent upon the income: for married people with an income of Dfl. 20,000 and less, the maximum expected result in subvariant b is achieved by the youngest generation, whereas for married people with an income of Dfl. 30,000 and more the maximum is achieved by the oldest generations. The picture changes only slightly in the case of unmarried people: only when the income is Dfl. 10,000 does the youngest generation have the maximum net result. When we look at subvariant c we see a further shift in the maximum net result towards the younger generations. For married people born in 1965, only people with an income of more than Dfl. 60,000 fail to achieve the maximum result. For unmarried people, too, there is a shift in the maximum net result from the older to the younger generations, at least for lower incomes.

Because of the fact that there is a real income growth in cases b and c, the net result is higher for everyone, but in both subvariants the net result for unmarried men is the lowest, whereas the net result for married couples is the highest.

In the foregoing we did not take into account differences in mortality rates between income groups or the duration of working life. This is not very realistic. We shall therefore now look at the results of two alternative variants. The results of subvariant a are shown in tables C2 and C3 of appendix C. Variant A uses an average difference in expected lifetime between the highest and the lowest income group of 8 (men), and 4 years

(women), respectively. In variant B this difference is 4 and 2 years, respectively. Concerning the average number of years worked, we assume that the difference between the highest and the lowest income group is 7 years.

A comparison of tables C2 and C3 with table C1 clearly shows that the redistribution of lifetime income is much smaller than was at first suggested. Notable is the fact that for the 1905 and 1915 generations and to a lesser extent some younger birth-generations, the net result increases with income under the conditions of variant A. This relationship is even more pronounced where the difference in growth between the wage rate and the interest rate is higher. Hence, it is most apparent in subvariant c, where we take into consideration the fact that the GOAPA system made lifetime incomes more unequal up to the year 1972. We shall return to this topic later.

This phenomenon also becomes clear in another way: tables 1, 2 and 3 give the premium percentage that has to hold for the income group

Table 2  
Variant A.

	Premium income						
	20	30	40	50	60	62.850 <sup>a</sup>	
Married couple	28.0	20.9	17.9	16.2	15.2	14.6	
Never married men	10.6	8.4	8.8	8.7	8.7	8.4	
Never married women	21.6	15.7	13.1	11.7	10.8	10.3	
	Premium income						
	70	80	90	100	110	120	125.7
Married couple	13.1	11.4	10.2	9.2	8.3	7.6	7.3

\*For incomes above Dfl. 62,850 the same premium percentage applies as for Dfl. 62,850 for unmarried people.

Table 3  
Variant B.

	Premium income						
	20	30	40	50	60	62.850 <sup>a</sup>	
Married couples	30.7	21.9	17.9	15.6	14.2	13.5	
Never married men	13.5	10.2	8.8	8.0	7.6	7.3	
Never married women	23.1	16.2	13.1	11.3	10.2	9.7	
	Premium income						
	70	80	90	100	110	120	125.7
Married couples	12.2	10.6	9.5	8.5	7.7	7.1	6.8

\*For incomes above Dfl. 62,850 the same premium percentage applies as for Dfl. 62,850 for unmarried people.

concerned if the sum of the expected net result is to be equal for everyone (people born after 1942 only). In the (fictitious) case that the growth of the wage rate is equal to the interest rate, this means that the sum of the contributions equals the sum of the expected GOAPA benefits.

The interpretation is quite simple: for example, in variant A in the case of a married couple with a household premium income of Dfl. 20,000, if the GOAPA premium percentage is continuously 28.0%, the net result of expected contributions and benefits equals the net result for an unmarried man with an income of Dfl. 60,000 when this man is paying a premium percentage of 8.7, and in this case an intergenerational redistribution would not be necessary. Table 1, which relates to the (probably not realistic) assumption that there are no differences in death rates and in years worked between the income groups, suggests that there is a large redistribution of lifetime income from higher to lower income groups. In this case married people in the lowest income groups pay far too little (the resulting percentage of 34.9% is much higher than the premium percentage that was applied in 1984) and the highest income group pays far too much.

If, on the other hand, we take into account differences in mortality rates and differences in the duration of working life between the income groups, then we can put on record that the distributive effect of the GOAPA system is less striking than initially suggested. The differences between the two variants (A and B) are rather small.

Vertical income transfers within the same generation mainly take place between married people and between unmarried women. Within the population of unmarried men there is no significant vertical redistribution: only the lowest income group receives some profit. It is noticeable that the percentages that apply to an income of more than Dfl. 40,000 (and for unmarried women as little as Dfl. 20,000) show little variation.

Horizontal distributive effects are more pronounced: a considerable income transfer is manifest from unmarried people to married couples, with unmarried men contributing more than unmarried women. Within a generation these horizontal transfers are larger than the vertical income transfers.

A consequence of the current premium percentage (11.65%) is that unmarried women with an income of up to Dfl. 40,000 and married couples with a premium income of up to Dfl. 70,000 pay comparatively too little premium and the other categories pay comparatively too much. For married people the current system is definitely advantageous, and this group in particular shows a distinct difference from the situation where differences in mortality rates between income groups are considered as being absent. About the year 2000, when the premium percentage will probably be between 14 and 15%, married people with an income of up to Dfl. 55,000 and unmarried women with an income of up to Dfl. 25,000 will be the only groups that make a relative 'profit' from the system.

This indicates another horizontal income transfer, namely from younger generations to older generations. This horizontal redistribution is caused by the way the system is financed (the pay-as-you-go system) and developments in the demographic field (see footnote 8). The fact that present-day premium percentages are relatively too low for the majority of the population also means an extra burden in the future on the shoulders of the younger generation, since for example the insufficient amount that is paid by married couples now will have to be counterbalanced by other generations later.

In view of the small differences in the premium percentages, it is true to say that for married couples with a premium income of between approximately Dfl.40,000 and Dfl.70,000 the GOAPA system at the moment equalizes the lifetime incomes only in a very modest way. It seems, indeed, rather as if at the present-day premium percentages the system makes lifetime incomes more unequal within the above-mentioned groups (see the results for the older generations in table C2). This is particularly true for the years before 1972, when the GOAPA premium percentage was less than 10%. In that period the payment deficit was larger for the higher income groups than for the lower income groups!

Summarizing, we can say that the vertical income transfers are comparatively less significant than our first calculations suggested. In this instance we did not take account of differences in mortality rates and duration of working life. Horizontal income transfers play a more important role within the same generation. There are extensive transfers from the unmarried to the married. Clearly, the system expects more solidarity from unmarried people with regard to married people than from higher income groups with regard to lower income groups. There is also an important intergenerational solidarity caused by the fact that the majority of people (especially the married ones) pay too little premium. This leads to an extensive transfer from younger to older generations.

## **6. The effects of the assumptions in section 3**

The first assumption, that in the long run the development of the income follows the development of the average gross income in the metallurgical industry, will probably not completely hold for higher incomes in the past. It is unlikely that these incomes experienced proportional growth. The consequence of this is that the contributions that have been paid are overestimated for the higher incomes, so that the net GOAPA result is underestimated. This means that the vertical redistribution will be still less than we have seen in section 5.

The second and the third assumptions require no further explanation. The third assumption received ample treatment in section 4, where the correction factor  $c_1$  was discussed.

The application of the same life table to all birth-generations leads to a slight overestimation of the net result for the older generations. Although the future is not foreseeable, it is very likely that the use of this life table underestimates the life expectancy of the younger generations, so that their net result will be underestimated. At this point we should observe that when the life expectancy of the younger generations rises gradually, the contributions for these generations will also be higher. Thus, the intergenerational redistribution from younger to older generations will be somewhat less, but not so much as to seriously affect the results of section 5 relating to this question.

In practice there are some differences in mortality rates differentiated by marital status: married people have a longer life expectancy than unmarried people. If these differences are ignored, the (horizontal) income redistribution from unmarried to married people is to some extent underestimated.

Assumption (5) leads to a small overestimation of the net GOAPA result for married couples (born after 1920), because of the fact that a number of partners (of an aged person) younger than 65 have incomes of their own, which implies that supplements will not be paid in full or even at all. Which in turn means that their net GOAPA result will be lower than estimated. As a consequence the horizontal redistribution from the unmarried to the married is overestimated.

The assumption that there will be no marriage or re-marriage after the age of 65 underestimates the net result for unmarried people. We do not have enough information on the real age at which people start their work careers for sensible comment. The increase in this age will be more gradual than is assumed here. What the distributional effects will be is not known.

As a consequence of the fact that the period during which the income is less than the mean income during working life is shorter than the period during which the income is greater, the lower premiums paid during the first period will be offset by the higher premiums paid later on (this is also caused by the increase in the GOAPA premium percentages, especially in the next century). So, assumption (8) induces an overestimation of the vertical beneficial effect of the pension scheme: the contribution will be larger according as the income is higher. Also, the underestimation of the contribution is larger for the younger generations than for the older ones. However, the consequences are rather limited and the general conclusions are not affected.

Summing up, we feel confident that the conclusions arrived at in section 5 retain their validity and even find further support from our analysis of the potential bias inherent in the assumptions. The horizontal redistribution from unmarried to married people is probably larger, whereas the vertical redistribution will be less than was apparent from the calculations. This confirms the importance of the horizontal redistribution. The intergenerational redistribution will be slightly smaller than was initially suggested.

## 7. Summary and conclusions

By means of some assumptions concerning the correlation between the long-term development of income and interest rates, the development of the level of GOAPA benefits, mortality rates, the age differences between husbands and wives, divorce and (re-)marriage after the age of 65, and the relation between income and age, we have derived a formula for the net GOAPA result of a birth generation [formula (6)].

By using a single life table and doing the calculations both for married couples (in which the wife lives longer than the husband) and unmarried men and women, we have incorporated the effect of institutional factors on the net GOAPA result of birth-generations.

All generations that were older than 15 on 1 January 1957 profited from the temporary provisions that applied at the moment the law came into effect. Depending on the subvariant, the 1905 and 1965 birth-generations have the highest net result. The way the benefits are financed (the 'pay-as-you-go'-system) induces, as a result of the changes in the structure of the population, a continued lower net result (when  $w(t)=r(t)$ ). The 1985 change in the law affects in a very negative way the net result of married couples in which husband and wife have a (rather) high income.

Using the results in appendix tables C2 and C3 and tables 1, 2 and 3 in the text, we went into the case of the effect of differences in death rates and differences in the duration of working life between income groups. The importance of the differences in mortality rates is very clear. Unfortunately, there are not enough data in the Netherlands to draw exact conclusions. But it is clear that despite the fact that the premium is levied as a percentage of income, the effect of the GOAPA system on the redistribution of lifetime incomes is much less than one is apt to think in the first instance. In particular, the vertical income redistribution, i.e. the redistribution between different income groups, is rather limited (especially for the same generation).

So, for married people with an income of between Dfl. 40,000 and Dfl. 70,000 the GOAPA system (at least up to 1972) increased the inequality in lifetime income! The income transfers between the different income groups on a lifetime basis are apparently much less than is suggested by the analysis of data that covers a limited period.<sup>9</sup>

Within the GOAPA system solidarity between income groups of the same generation is rather limited. More solidarity is expected from unmarried people, especially unmarried men. There are substantial income transfers from this group to married people. In addition, an intergenerational solidarity effect is observed in terms of the net transfers from the young to the old.

Another important conclusion was that up to 1985 the majority of the population was contributing relatively too little to avoid intergenerational

<sup>9</sup>See, for example, Muffels, Nelissen and Nuyens (1986).

redistributions as well, especially married people. This is an important cause of the increase of the burden in the future. Today's insufficient contributions will have to be compensated for at a later date. As a result of demographic developments this extra money will have to be furnished by fewer people. The government would be well advised to perceive this as a reality for its policy. An increase of the GOAPA premium percentage up to the percentage that is minimally necessary to cover the financial needs of a generation (about 13.5% in the Dutch case) is the least that can be done. However, a consequence of this would be that the purely pay-as-you-go system would be partly abandoned.

This example of the Dutch situation contains some elements that are also important for other countries in Western Europe. The most important one will probably be the development of the premium percentages in the future. Appendix B shows that in the situation of a stagnating population growth the pay-as-you-go system for old age pensions leads to very high premium percentages after some decades. In a situation of declining population (the Netherlands after the year 2005) the percentages reach such high levels that the premium will probably be unpayable. The opposite will happen if the population growth rate shows a gradual increase. In this case the pay-as-you-go system implies that people pay too 'little' a contribution.

With respect to income policy, we come to the interesting conclusion that the vertical redistribution in pay-as-you-go old age pensions is rather limited in a lifetime, whereas horizontal transfers from the unmarried to the married play an important role. Hence, the system implies solidarity claims, but in practice these are different from what was intended: not so much from the rich to the poor as from the unmarried to the married.



**Appendix A: Correction factors  $c_1(t_1)$  for the level of the GOAPA benefit**

Table A1

Year ( $t_1$ )	Married	Unmarried
1957	0.54	0.47
1958	0.56	0.50
1959	0.58	0.51
1960	0.59	0.53
1961	0.55	0.50
1962	0.63	0.58
1963	0.68	0.63
1964	0.68	0.63
1965	0.78	0.79
1966	0.82	0.83
1967	0.82	0.83
1968	0.79	0.80
1969	0.83	0.84
1970	0.86	0.88
1971	0.95	0.96
1972	0.93	0.95

*Note:* The correction factor is calculated as the quotient of the level of the GOAPA benefit and the net minimum wage in 1972, corrected by the price-index figure for national income.

# Appendix B: Premium percentages pursuant to the GOAPA; 1957–1984 and projections for the period 1985–2030

Table B1

Year <sup>a</sup>	Percentage	Year	Percentage	Year	Percentage
1957	6.75	1967	8.8	1977	10.4
1958	6.75	1968	9.0	1978	10.45
1959	6.75	1969	9.1	1979	10.4
1960	5.5	1970	9.5	1980	10.25
1961	5.5	1971	9.9	1981	10.6
1962	5.75	1972	10.3	1982	11.05
1963	6.8	1973	10.4	1983	11.65
1964	6.8	1974	10.6	1984	11.65
1965	8.7	1975	10.4		
1966	8.7	1976	10.4		
1985	12	2005	15	2025	22
1990	13	2010	16	2030	23
1995	14	2015	18		
2000	14	2020	20		

<sup>a</sup>The intervening years are interpolated.

*Note:* It would be more correct to use the premium percentages that result from the mortality table applied to all people born in the past instead of the real percentages that, among other things, are fixed as a result of actual death rates. But, because the changes in the death rates have a bearing on the younger ages, the deviations that result from our method of calculation are very small.

*Sources:* Centraal Bureau voor de Statistiek, *Sociale verzekering, pensioenverzekering, levensverzekering*, Staatsuitgeverij, s-Gravenhage; Europese Economische Gemeenschap Commissie, *Verslag over de ontwikkeling van de sociale toestand in de Gemeenschap in 1900*, Publikatiediensten van de Europese Gemeenschappen; F.A.J. van den Bosch, P.J.C. van Eekelen and C. Petersen, 'De toekomst van de AOW: verdubbeling van de premies of halvering van de uitkeringen?', *Economisch Statistische Berichten* 68, no. 3431, pp. 1052–1058.

**Appendix C: The expected net GOAPA result for the 1905–1965 birth-generation at age 65 for different household incomes (corrected for price inflation and real income increases; 1984 figures thousands of guilders).**

Table C1  
Basic variant, subvariant a.

Birth year	Income 10	20	30	40	50	60	62.850
(a) Married couples							
1905	414	407	399	392	384	381	381
1915	375	355	336	316	297	290	290
1925	353	321	289	258	226	208	206
1935	339	294	248	203	157	126	120
1945	326	267	208	149	90	44	33
1955	320	254	189	124	59	1	-17
1965	311	236	162	88	14	-55	-82
	Income 70	80	90	100	110	120	125.7
1925	221	229	209	202	196	190	187
1935	125	119	85	65	46	26	14
1945	28	7	-41	-76	-111	-146	-166
1955	-35	-73	-140	-192	-245	-298	-327
1965	-115	-175	-263	-337	-412	-486	-528
	Income 10	20	30	40	50	60	62.850
(b) Unmarried men							
1905	211	203	196	188	180	178	178
1915	180	160	141	121	102	95	95
1925	161	129	97	65	34	16	14
1935	147	102	56	11	-35	-67	-73
1945	134	75	16	-43	-102	-140	-159
1955	127	62	-3	-68	-134	-191	-209
1965	118	44	-30	-104	-178	-257	-274
(c) Unmarried women							
1905	273	265	258	250	242	240	240
1915	242	222	203	183	164	157	157
1925	223	191	159	127	96	78	76
1935	209	164	118	73	27	-5	-11
1945	196	137	78	18	-41	-86	-97
1955	189	124	59	-6	-72	-129	-147
1965	180	106	32	-42	-116	-185	-212

## Subvariant b

Birth year	Income 10	20	30	40	50	60	62.850
(a) Married couples							
1905	417	410	402	394	387	384	384
1915	398	378	359	339	289	270	268
1925	417	385	353	321	289	270	268
1935	448	401	354	307	259	226	220
1945	483	419	355	291	227	175	164
1955	528	451	374	298	221	149	131
1965	571	475	378	282	186	89	62
	Income 70	80	90	100	110	120	125.7
1925	289	301	276	270	264	257	254
1935	232	231	189	167	146	124	112
1945	166	148	86	46	6	-33	-56
1955	119	80	-9	-73	-137	-201	-238
1965	31	-39	-162	-259	-355	-452	-507
	Income 10	20	30	40	50	60	62.850
(b) Unmarried men							
1905	211	203	196	188	180	178	178
1915	186	167	147	128	108	101	101
1925	186	154	122	90	58	40	38
1935	194	147	100	52	5	-29	-35
1945	202	138	74	10	-54	-106	-117
1955	218	141	64	-13	-89	-161	-179
1965	229	132	36	-61	-157	-254	-281
(c) Unmarried women							
1905	274	266	259	251	243	241	241
1915	256	236	217	197	178	171	171
1925	263	231	199	167	135	117	115
1935	279	232	185	137	90	56	50
1945	296	232	168	104	40	-12	-23
1955	321	245	168	91	14	-57	-76
1965	343	247	150	54	-43	-139	-167

## Subvariant c

Birth year	Income 10	20	30	40	50	60	62.850
(a) Married couples							
1905	420	412	405	397	390	387	387
1915	423	404	384	365	345	339	339
1925	491	459	427	395	363	344	342
1935	589	540	491	442	393	357	351
1945	708	638	568	497	427	370	357
1955	857	766	675	583	492	406	383
1965	1029	902	775	648	521	394	358
	Income 70	80	90	100	110	120	125.7
1925	370	387	357	350	344	337	333
1935	374	379	327	303	280	256	243
1945	372	362	280	234	188	143	116
1955	386	351	229	150	71	-7	-52
1965	339	265	85	-42	-169	-296	-368
	Income 10	20	30	40	50	60	62.850
(b) Unmarried men							
1905	211	203	196	188	180	178	178
1915	193	173	154	134	115	108	108
1925	215	183	151	119	87	68	66
1935	253	204	154	105	56	21	14
1945	298	228	157	87	17	-41	-54
1955	357	266	174	83	-8	-95	-117
1965	420	293	165	38	-89	-216	-252
(c) Unmarried women							
1905	275	267	260	252	245	242	242
1915	271	252	232	212	193	186	186
1925	311	279	246	214	182	163	161
1935	369	320	271	222	173	137	130
1945	439	369	299	229	159	101	88
1955	530	438	347	256	165	78	58
1965	630	503	376	249	122	-5	-41

Table C2  
Variant A, subvariant a.

	Income 10	20	30	40	50	60	62.850
<i>a</i>	2	2	1	-1	-3	-5	-5
<i>b</i> <sub>1</sub>	-4	-4	-2	0	2	4	4
<i>b</i> <sub>2</sub>	-2	-2	-1	0	1	2	2
<b>Birth year</b>							
<b>(a) Married couples</b>							
1905	363	356	374	392	409	431	431
1915	323	304	310	316	322	341	341
1925	302	270	264	257	252	259	257
1935	288	242	223	203	183	177	171
1945	274	215	182	150	121	107	97
1955	266	198	160	129	104	85	70
1965	257	180	133	93	58	28	9
<b>(b) Unmarried men</b>							
1905	149	142	166	188	208	233	233
1915	125	105	113	121	129	150	150
1925	106	74	70	65	61	70	69
1935	92	47	29	11	-7	-12	-17
1945	79	20	-12	-42	-69	-82	-92
1955	70	2	-34	-63	-86	-104	-119
1965	61	-16	-61	-99	-133	-160	-180
<b>(c) Unmarried women</b>							
1905	245	238	244	250	256	267	267
1915	214	195	189	183	177	184	184
1925	195	163	145	127	109	105	103
1935	182	136	104	73	41	23	17
1945	168	109	64	20	-21	-48	-57
1955	159	92	41	-1	-38	-69	-84
1965	150	74	15	-37	-84	-126	-145

*a* is the number of years that a person has worked more than (+) or less than (-) the figure in the base variant.

*b*<sub>1</sub> is the deviation from the mean life expectancy (men).

*b*<sub>2</sub> is the deviation from the mean life expectancy (women).

Table C3  
Variant B, subvariant a.

	Income 10	20	30	40	50	60	62.850
<i>a</i>	2	2	1	-1	-3	-5	-5
<i>b</i> <sub>1</sub>	-2	-2	-1	0	1	2	2
<i>b</i> <sub>2</sub>	-1	-1	-0.5	0	0.5	1	1
Birth year							
(a) Married couples							
1905	390	382	387	392	410	406	406
1915	349	330	323	316	323	316	316
1925	327	296	277	258	252	233	231
1935	314	268	236	203	184	151	145
1945	300	241	195	150	122	81	71
1955	292	224	173	129	105	59	44
1965	283	206	146	93	59	3	-17
(b) Unmarried men							
1905	181	174	181	188	194	205	205
1915	152	133	127	121	115	122	122
1925	133	102	84	65	47	43	41
1935	120	74	42	11	-21	-39	-45
1945	106	47	2	-42	-83	-109	-119
1955	98	30	-20	-63	-100	-131	-146
1965	89	12	-47	-99	-146	-188	-207
(c) Unmarried women							
1905	259	251	251	250	235	254	254
1915	228	208	196	183	157	171	171
1925	209	177	152	127	89	91	89
1935	195	150	111	73	20	9	3
1945	182	123	71	20	-42	-61	-71
1955	173	106	48	-1	-59	-83	-98
1965	164	88	22	-37	-105	-140	-159

*a* is the number of years that a person has worked more than (+) or less than (-) the figure in the base variant.

*b*<sub>1</sub> is the deviation from the mean life expectancy (men).

*b*<sub>2</sub> is the deviation from the mean life expectancy (women).

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